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NEW ZEALAND

BOTANY DIVISION

1960-62

TRIENNIAL REPORT

D.S.I.R. photo by C. J. Miles.

FRONTISPIECE. THE NEW BUILDING, LINCOLN. HERBARIUM (right), ADMINISTRATION (centre), LIBRARY (left, obscured), LABORATORY AND OFFICE WING (rear). Officially opened on 19 September, 1960.

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Botany Division

CHRISTCHURCH - NEW ZEALAND

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INTRODUCTION

THE SECOND Triennial Report from Botany Division covers the first three years in the new quarters at Lincoln which we entered in May 1960.

It was indeed appropriate that the new building should have been officially opened by the Hon. P. N. Holloway, Minister in Charge of Scientific and Industrial Research. For he is a son of a distinguished New Zealand botanist, the late Professor J. E. Holloway, F.R.S., noted for his researches on *Hymenophyllum, Lycopodium* and *Tmesipteris*. In the evening of that day we were hosts to a large gathering of friends of the Division, when the building was open for leisurely inspection and displays of the work in progress were presented.

The period under review has been one of settling-in and development. The experimental gardens of some 29 acres are now almost completely laid out; a major part of the herbarium is now in working order under modern conditions; and a new aspect of work—the classification of horticultural plants—has commenced. A notable event in these three years was the publication in 1961 of the first volume of the "Flora of New Zealand" written in his retirement by Dr H. H. Allan, the first Director of Botany Division. Members of our staff collaborated in many ways with this work, particularly Dr L. B. Moore, who, after Dr Allan's death in 1957 wrote several sections and saw the volume through the press.

It is perhaps relevant here to comment further on the functions of Botany Division outlined briefly below. Our first task is to make means available for the identification of the plants of New Zealand. The main tools in this work are the herbarium, the library, and the experimental gardens. Identifications are continually being made for many organisations and research workers, but our main service is, as it should be, through the production of papers, monographs, and Floras to make the information widely available and useable. Studies in cytology, genetics, and pollen morphology are carried out and often help to confirm the conclusions of the taxonomist, or provide suggestions for further work, but these disciplines also provide research opportunities in their own right.

The delimitation of species is of course only the necessary first step. Accurate distribution maps must be prepared, and the life of the plant studied in depth. Breeding systems, seed production and germination, factors controlling establishment and geographical distribution, interactions with animals, all this information is necessary before we can claim to understand something of the biology of our plants. As the following pages show a beginning has been made on some of this work, and much valuable information is derived from the vegetation surveys reported herein.

Attention should also be drawn to the very important duties of staff members on various committees. In our associations with the affairs of

National Parks, Nassella Tussock Boards, Catchment Boards and other organizations we are able to bring experience gained in our investigations to bear on immediate problems, and in turn to become better aware of problems requiring solution.

Functions and Location

The main function of Botany Division is to study the plants of New Zealand. We seek to describe and classify the native, adventive and horticultural flora, and to describe the vegetation whether old or new, past or present. To facilitate these aims, research is carried out in genetics, cytology, anatomy, morphology, physiology and ecology. The information thus obtained is made widely available both here and overseas.

The Division's headquarters is near the township of Lincoln, 14 miles south-west of Christchurch in South Island.

Location	Latitude 43 deg. 38 min. South. Longitude 172 deg. 30 min. East. Height above sea level 36 feet.
Soil	Headquarters Block. Whakanui silt loam on sand, mottled phase. East Block. Templeton soils, ranging from very stony to moderately deep loams.
Rainfall	25 inches per annum on 125 days. Distribution erratic, late spring droughts common.
Mean Evap.	36.71 inches per annum (11 years).
Rainfall/Evap.	0.681.
Temperature	Mean Maximum 61.0 deg. F. Mean Minimum 44.3 deg. F. Mean 51.1 deg. F.
Humidity	71.5 per cent (at 9 a.m.).
Days of ground frosts 93.	
Hours of sunshine 2005.	

SUB-STATIONS. The North Island sub-station is situated at the headquarters of Soil Bureau, D.S.I.R., at Taita, Lower Hutt, near Wellington.

THE HERBARIUM

(International Code, CHR)

(*Herbarium Keeper,* Mr T. W. Rawson)

The transfer of the Division to the new building at Lincoln marked the beginning of yet another stage in the development of the herbarium. For the first time adequate space is available not only for storage but also for the study of specimens. And the method of housing specimens

has also been improved, as cabinets will now be used in place of the cardboard boxes in which specimens have been stored hitherto. It is planned to have alternate rows of cabinets with the top of the lower (40 inch) rows providing useful bench space between the taller (80 inch) rows. Only the 40 inch cabinets have been installed so far and the following groups have been transferred to them: Ferns, Lycopods, Gymnosperms, Dicotyledones (Hutchinson's Families 1-182 only), and Monocotyledones (portion of the *Cyperaceae* and portion of the *Gramineae*).

We have taken advantage of this transfer of specimens to integrate the previously separate, native, overseas, adventive, and duplicate sections. Some of the closed collections have also been incorporated into the general collection. Labelling of cabinets, and preparation of new folders for specimens is largely completed as also is the card index of genera deposited in the herbarium. Other major tasks have been the reorganisation of the native Dicotyledons to correspond with Volume I of Allan's "Flora of New Zealand"; despatch of comparative sets to Kew of *Pomaderris, Euphrasia, Ourisia, Parahebe* and *Myosotis,* to illustrate new taxa; and work on the Monocotyledon and Adventive sections in preparation for later volumes of the Flora.

The collection continues to grow steadily and approximately 15,000 specimens have been added during the last three years.

Some special collections deposited by staff members are:

1. Cultivated trees and shrubs: Mr W. R. Sykes.
2. Mt Egmont National Park plants: Mr A. P. Druce.
3. Nelson Lakes National Park plants: Mrs M. J. A. Bulfin.
4. Campbell Island plants: 1960-61 expedition.
5. Auckland Island plants: 1962-63 expedition.
6. A duplicate set of a collection of New Zealand plants made by Dr R. Melville of Kew while D.S.I.R. Senior Research Fellow at Botany Division.
7. A duplicate set of a collection of New Zealand liverworts made by Dr Jane Taylor, while National Research Fellow at Botany Division.
8. The lichen collection has been expanded by various staff members.

We are also extremely grateful for the following donations:

1. The F. G. Gibbs herbarium: a gift through Miss H. M. Jenkins (niece of Mr Gibbs) and Dr H. H. Allan. This collection is rich in Nelson specimens and includes many isotypes. Its value has been enhanced by the loan, from Miss Jenkins, of files of letters received by Mr Gibbs from other botanists.
2. Mr William Martin of Dunedin donated his extensive moss collection.
3. Mr W. B. Brockie of Richmond donated a collection of plants from Campbell Island.

4. Mr D. A. Franklin of Wellington donated specimens of *Gaultheria* and *Pernettya* illustrating his paper in the Transactions of the Royal Society of New Zealand, 1962.
5. Dr R. Ornduff donated specimens illustrating his work on the *Senecio lautus* complex, including specimens of some artificial hybrids.
6. Mr C. H. W. Dunn of Christchurch donated specimens of *Clematis*.
7. A set of 84 specimens of algae was received from the Herbarium of the University of California, Berkeley.
8. A set of 50 specimens of algae (2 fascicles) was received from the Phycological Herbarium, University of British Columbia.
9. A collection of South Georgian plants was donated by Mr S. W. Greene, Botany Department, University of Birmingham.

LIBRARY

(Miss B. E. Harris, Mrs M. E. Blackmore)

DURING the last three-year period the library has developed steadily, and in 1962 new shelves to the extent of 165 running feet were added.

We are extremely grateful for the following donations.

1. Presented by Mr H. W. Gourlay, Christchurch.

Agardh, J. G.	Species genera et ordines algarum. Vols. 1, 2 and 3. 1848-1901.
Børgesen, F.	The marine algae of the Danish West Indies. Vols. 1 and 2. 1913-20.
Kuckuck, P.	Beiträge zur Kenntnis der Meeresalgen. Articles 10-13. n.d.
Kylin, H.	Die Delesseriaceen Neu-Seelands. 1929.
Kylin, H.	Studien über die Delesseriaceen. 1924.
Laing, R. M.	The marine algae of the Subantarctic Islands of New Zealand. (Reprinted from Subantarctic Islands of New Zealand.) 1909.
Oltmanns, F.	Morphologie und Biologie der Algen. 2 Auflage. 1922-23. 3v.
Setchell, W. A.	The Scinaia assemblage. 1914 .
Setchell, W. A. and Gardner, N. L.	A preliminary survey of Gigartina, with special reference to its Pacific North American species. 1933.
Skottsberg, C.	Zur Kenntnis der subantarktischen und antarktischen Meeresalgen. 1 Phaeophyceen. 1907.

D.S.I.R. photo by A. P. Underhill.

1. The Herbarium, southern end. (Miss B. H. Macmillan).

D.S.I.R. photo by C. J. Miles.

2. Botany Division from the east. Hebbarium (left), women's room and preparation room (centre), laboratory and office wing (right).

2. Presented by Miss H. Jenkins, Nelson.
   Mann, S. — F. G. Gibbs; his influence on the social history of Nelson, 1890-1950. Thesis.

3. Presented by Professor H. Walter, Stuttgart-Hohenheim.
   Walter, H. — Die Vegetation der Erde in ökologischer Betrachtung, Band 1. 1962.
   Walter, H. — Einführung in die Phytologie, Band 3. Grundlagen der Pflanzenverbreitung, Teil 1, Standortslehre. 2 Auflage. 1961.

4. Presented by Mr L. W. McCaskill, Christchurch.
   Cheeseman, T. F. — Manual of the New Zealand Flora. 2nd edition. 1925.
   Kirk, T. — Students Flora of New Zealand and the Outlying Islands. 1899.
   Both originally belonging to, and annotated by Mr W. A. Thomson of Dunedin.

5. Presented by Mr S. H. Saxby, Wellington.
   Cheeseman, T. F. — Manual of the New Zealand Flora. 1st edition. 1906.
   A gift from Sir James Hector to his son, Dr Charles Monro Hector.

6. Presented by Dr Jane Taylor.
   Spruce, Richard — Hepaticae Amazonicae et Andinae quas in itinere suo per tractus montium et fluviorum Americae Aequinoctialis . . . decerpsit . . . Richard Spruce. Edinburgh, Botanical Society. 1884-5. xi, 588 pp. 22 plates. (Trans. Bot. Soc. Edinburgh. Vol. 15.)

7. Presented by Dr L. B. Moore, Lincoln.
   Tripp, F. E. — British mosses, their homes, aspects, structure, and uses. London, G. Be. . & Sons, 1874. 2v.

8. Presented by Dr J. B. Hair, Christchurch.
   Making New Zealand. 2v.

9. Presented by the Director of Parks and Reserves, Christchurch.
   A Garden Century. The Christchurch Botanic Gardens, 1863-1963.

10. Presented by the University of Canterbury.
    Edgar, E. — Fluctuations in mitotic index in the shoot apex of *Lonicera nitida*. Christchurch University of Canterbury. 1961.

11. Presented by Mr W. B. Brockie, Richmond.
    Musgrave, Thomas — Castaway on the Auckland Islands. (Reprint, 1943.)

12. Presented by Miss G. Marie Taylor (Mrs J. Fulmer), Oamaru.
    The original illustrations for her two papers on *Coprosma* (Tuatara, 1961).

THE EXPERIMENTAL GARDENS

1. Lincoln headquarters, South Island (Officer in charge, Mr I. C. Brown).

General.

The land available for experimental work consists of approximately five acres in Headquarters Block and an additional eighteen acres half a mile to the north-east, in East Block. Whether for short- or long-term projects, facilities for studying a great variety of native and adventive plants in cultivation have become of major importance to the taxonomic and related studies now in progress or planned for the future. The work undertaken during the period under review has been largely designed to improve and extend these facilities.

Developmental.

(*a*) Shelter Belts: Steady growth of the hedges surrounding H.Q. Block now affords some protection to field plantings. At East Block however, the prevailing north-east winds have severely retarded the establishment of shelter belts; to overcome this problem a quick-growing temporary and protective planting of willows and poplars is being made to assist the establishment of a permanent belt.

(*b*) Lawns and Beds: Lawns have now been established round the main buildings and the car park, and some borders and beds developed and planted. East Block has been completely sown down in lawn for the time being; plots and borders will be established as required.

(*c*) Irrigation: The installation of an extensive underground pipe system of irrigation throughout the whole experimental area now ensures an adequate water-supply wherever required. This system is fed by a newly constructed polythene reservoir of 250,000 gallons capacity at East Block; the reservoir is shared with the Grasslands Division sub-station and with the Vegetable Research Station of Crop Research Division.

A water race has been diverted to pass through East Block, and to follow the higher contours of the area. It is proposed to use this stream for experimental plantings of aquatic plants.

(*d*) Roading: Internal roads, and a car park (capacity, 23 vehicles) have been constructed and sealed at H.Q. Block. Roading within East Block is now being developed at top course stage.

(*e*) New Buildings etc.: New and improved cultural facilities have greatly extended the range of environments necessary for the growing of plants in pots.

Two new aluminium framed grasshouses, 25ft. x 10ft. and 7ft. 6in. x 10ft. respectively, have been constructed. Both have an electrical heating system with thermostatic control, and they are provided with concrete plunging pits in lieu of the conventional bench-style staging. The pits are of prefabricated construction—prestressed concrete boards, 12in. x 1in., form the base, and bear on reinforced concrete beams. The

system has proved very successful in reducing evaporation and thus in keeping direct top-watering of plants to a minimum.

A further cold frame has been built making available a series of three. Two additional outdoor concrete plunging pits have been provided for hardy plants in pots. The deleterious effects of drip from the rafters of the two shade-houses, particularly in winter conditions, has been overcome by covering the roofs with polythene sheeting.

A new implement shed, 60ft. x 18ft. on H.Q. Block, has partly solved the problem of housing an increasing amount of farm machinery and other equipment, and this has storage and workshop facilities.

A further implement shed, 40ft. x 18ft., has also been built at East Block but in the main has to cope with a large overflow of stores from H.Q.

Planting Programme.

(*a*) Field Plots (H.Q. Block): Recent planting in established plots include extensive collections of *Festuca, Agropyron, Chionochloa, Poa, Hebe, Juncus,* and *Luzula.* Three new plots have been brought into cultivation for major long-term plantings of *Cortaderia* and *Chionochloa.*

(*b*) Species and other Collections: Substantial progress in the development of the gardens has permitted the establishment of the first of a series of permanent species collections for long-term study, commencing with *Hebe.* The *Hebe* collection is located in H.Q. Block. It now comprises 59 of the 79 taxa at present described, excluding the whipcord and semi-whipcord species which will be established elsewhere. As far as possible the planting order follows the arrangement in the new Flora. The field planting is on a population basis, arranged geographically, thus allowing numbers of plants of each species from a wide range of localities to be observed and compared in uniform environment.

The same procedure will be followed in other genera suitable for outside planting; nucleus collections of *Olearia, Coprosma* and *Pittosporum* amongst others, have already been started for this purpose.

Collections of *Rubus* and *Astelia* occupy a border running the full length of the car park. A collection of *Sophora* species has been lined out on both sides of the back entrance to the main building; a much larger planting of some 250 plants is designed as a border for the interior roading in East Block, 75 of these plants being already established there.

A group of divaricating shrubs from widely separated families has been established in beds fronting the main buildings.

Other large collections for scientific purposes are being maintained in pots, particularly *Ranunculus, Sophora, Carex, Astelia, Senecio, Cotula, Nertera, Hydrocotyle, Gunnera, Poa,* and *Festuca.* To these should be added recent gatherings of live plants from the Campbell and Auckland Islands.

2. Taita Substation, Soil Bureau, Lower Hutt, North Island (Officer in Charge, Mr A. P. Druce).

During the last three years about 500 of the 700 odd different mountain plants of the North Island have been grown experimentally in pots at the Soil Bureau. Special attention has been paid to comparing plants from Mt Egmont with those from elsewhere in the North Island, and it has been demonstrated that subspeciation has taken place in some eight species on Egmont. From the experimental work it appears that about 70 (ten percent) of the mountain plants are yet to be named. When the growing plants are no longer required they are pressed and dried in the usual manner, and then passed over to the herbarium at Lincoln so that they will be available for further study.

SEED EXCHANGES

(Mrs M. J. A. Bulfin)

ALTHOUGH the seed list is not now distributed annually, interest in seed of indigenous species continues, perhaps more by scientists requiring seed for a particular project than in the past when requests were predominantly from Botanic Gardens. A chemist in America requested 25-100 lbs. of seed of *Corynocarpus laevigatus* in order to compare compounds already isolated by him with those reported from *C. laevigatus*. Another worker wished to investigate *Solanum laciniatum* and *S. aviculare* as a possible crop source of the steroidal alkaloid solasodine.

Interest from Botanic Gardens continues however, and this year Kew Gardens have requested *Nothofagus truncata* to add to their collection. The University of Washington Arboretum also required *Nothofagus* species for their gardens. Alpines and ornamental species are in regular demand by Botanic Gardens and within New Zealand requests have been fulfilled for scientists requiring, *Mimulus repens, Coriaria* spp., *Urtica ferox, Carmichaelia* spp. etc. Requests have been received from workers on a particular genus for N.Z. representatives of *Sonchus, Erechtites* etc.

Many of the species requested are restricted to local areas and it is becoming more and more necessary to rely on friends and contacts of the Division in various parts of the country to collect seed for us. This year the Department of Agriculture officer in the Chatham Is. collected seed of *Sonchus grandifolius* required by a monographer in Egypt and Mrs S. Natusch of Wellington collected *S. littoralis* for the same worker. Mrs K. Wood of Auckland collected *Weinmannia silvicola* requested from Switzerland and India and Mrs J. Moss of Nelson collected 70 lbs of *Corynocarpus laevigatus* seed.

About thirty inquiries for a wide range of species are received annually.

TAXONOMY

1. Flora of New Zealand, Volume 1 (Dr L. B. Moore).

Volume 1 of Flora of New Zealand by the late H. H. Allan was published on 27 April 1961. The volume contains over 1100 pages but it is only about 1 inch thick because a fine white bible paper was chosen; additional notes following the formal descriptions are in small (6pt) type with the result that a great deal of information is assembled in a rather small book. All indigenous plants except the monocotyledons are dealt with, a total of 1457 species of which 1273 are dicotyledons; the only infraspecific category used is the variety, and these number 280. Three genera, 29 species and 61 varieties described as new are furnished with latin diagnoses. For each species the basionym and essential synonymy are given, and for most the type specimen and its location are recorded. Distributions within New Zealand are indicated only in rather general terms. Many notes suggest lines along which further study is required and references are provided to some 200 or more names whose status has yet to be decided. Sections preceding the descriptive text are Annals of taxonomic research on N.Z. Tracheophyta, The New Zealand Botanical Region, Abbreviations, Signs and Measures, Names of Authors and Synopsis of classes and orders; Glossary, Maori names of plants, Supplementary notes (26 pp.) and Index (49 pp.) follow. Dichotomous keys are provided to families, genera and species and some of these are illustrated by groups of line drawings by Nancy M. Adams. Maps occupying the end papers show the N.Z. Botanical Region with bathymetric contours of the surrounding sea, the southern islands in relation to larger land masses and North and South Islands. Sections prepared by authors other than Dr Allan are: by L. B. Moore—Balanophoraceae, Boraginaceae, *Haloragis, Hebe* (except whipcord species), *Myoporum* (in part), *Myriophyllum* (with assistance from R. Mason), *Ourisia, Pomaderris, Tecomanthe;* by M. B. Ashwin—*Euphrasia, Hebe* (whipcord species), *Parahebe, Pygmea.*

2. Flora of New Zealand, Volume 2, Monocotyledones.

(*a*) Dr L. B. Moore. Work has proceeded steadily towards the second volume, the Orchidaceae being the last remaining family to be attacked. Miss R. Mason's collections and her study of aquatic plants provide an exceptionally well-documented background for the families Juncaginaceae, Zosteraceae, Potamogetonaceae, Ruppiaceae, Zannichelliaceae, Lemnaceae and Typhaceae. Outstanding recent acquisitions include living plants of such small rarities as *Iphigenia* and *Hypoxis,* and good herbarium specimens of all three South American species of *Luzuriaga* for comparison with those in New Zealand. Special attention has been paid to the asteliads; Cheeseman listed 8 entities in 1906, and 11 in 1925, all in the genus *Astelia;* Skottsberg in 1934 recognised 15 taxa and placed three species in his new genus *Collospermum;* supple-

mentary material, mostly living, confirms this arrangement and extends it by the addition of at least 3 new taxa, raising the total to a minimum of 18. In this, as in several other groups, critical revision demonstrates the peculiar interest of the north-west Nelson area from the point of view of plant geography. Collaboration with the cytology section (Dr J. B. Hair) and with Fats Research Laboratory (Dr I. Morice) is acknowledged.

(b) Mr V. D. Zotov. A "Synopsis of the Grass Subfamily Arundinoideae in New Zealand" has been published (N.Z. Journ. Bot. Vol. 1), and includes both native and introduced species. The genera included are: *Arundo* (1 introduced species), *Phragmites* (1 intr.), *Cortaderia* (1 intr., 3 indigenous), *Sieglingia* (1 intr.), *Chionochloa* (19 indig.), *Notodanthonia* (22 indig. and intr.), *Erythranthera* (2 indig.) and *Pyrrhanthera* (1 indig.).

The three New Zealand toetoes, *Cortaderia,* were previously placed in *Arundo.* The genus *Danthonia* as understood in the treatment does not occur in New Zealand. The species previously placed in that genus are now grouped in two new genera *Chionochloa*—the snow-grasses—and *Notodanthonia.* The former are mostly coarse grasses with the known chomosome numbers 2n = 36 and 42. The latter genus consists mainly of fine grasses with the known chomosome numbers in even multiples of 12. The species of *Triodia* of Cheeseman's Manual are transferred to the new genus *Erythranthera* excepting the small rhizomatous species whose fruit is a nut. This latter is placed in *Pyrrhanthera* a new monotypic genus.

The Arundinoideae is a group of considerable physiognomic or economic significance in New Zealand. The toetoe is often characteristic of the landscape and also of value as an ornamental plant. The snow-grasses are widespread mountain species and often dominant members of the tussock grasslands. The Notodanthonias contributed in the past, and to some extent still do, important constituents to our hill pastures. The identity of these is now established.

Concurrently with the study of Arundinoideae work on other grasses continues. To gain further material and field experience extended field trips were made to Campbell Island (January 1961), Dusky Sound, Fiordland (February 1962) and the mountains of Central Otago (February 1963). The grass herbarium now contains some 8000 sheets of indigenous plants, 4000 sheets of introduced plants, and 4000 sheets of foreign plants. In addition a volume of duplicate material is now building up and is becoming available for exchange with overseas herbaria.

Sets of New Zealand Arundinoideae are being prepared for New South Wales National Herbarium and Kew Herbarium in return for valuable parcels received from them.

(c) Dr E. Edgar. Work continues on the Juncaceae, Centrolepidaceae, Restionaceae and Cyperaceae.

3. *Nertera* (Miss R. Mason).

The species of *Nertera* (Rubiaceae) in New Zealand are being studied. A new species, hitherto confused with *N. dichondraefolia,* but amply distinct from that species has been recognised. *N. scapanioides* Lange, has been rediscovered and is now known from several localities.

EXPERIMENTAL TAXONOMY AND PHYSIOLOGY

1. *Juncus* (Dr E. Edgar)

The New Zealand members of the group of rushes which Buchenau named the *"Junci genuini"* present difficulties to the taxonomist. Although the main species in this group have been distinguished there still remain a number of intermediate forms. All the native species of *Junci genuini* have at one time or another been reported to hybridise (see Cockayne, L. and Allan, H.H. in *Ann. bot.* 48, 1934), and numerous herbarium specimens are labelled as hybrids. This is all the more interesting as it is quite common to find up to six different species of rushes growing closely together, with no plants which appear intermediate.

(a) Breeding System. The breeding system of these species of *Juncus* is being investigated and all species tested have proved to be self-fertile. In three of the species, selfed plants have been compared with open-pollinated plants and they showed no inbreeding depression.

(b) Interspecific hybridization. So far three artificial hybrids have been made. In one hybrid the F_1 and F_2 were completely fertile; in the second the F_1 was stunted and set no seed. The third hybrid was made recently. A high proportion of seed was set and several hundred F_1 seedlings have now germinated.

2. *Festuca* (Mr H. E. Connor)

Interspecific hybrids are readily produced from hand pollinations between the indigenous species *Festuca novae-zelandiae* and *F. matthewsii.* Hybrids between these morphologically, physiologically and ecologically distinct species have proved fertile at F_1, in a small F_2, and in the first backcross to both parents. Larger progenies are being raised to further determine interfertility and to establish the inheritance of characters commonly used to distinguish these two allogamous species.

3. *Agropyron* (Mr H. E. Connor)

Hair (Heredity, 1956) has shown that among the pseudogamous

phenodemes of *A. scabrum* there are three levels of asexuality. Efforts are continuing to determine the genetic relationship between apomictic phenodemes and sexually reproducing phenodemes. Hybrids have been obtained using pollen from phenodemes representing these three levels. Generally these are sterile though one Waipara (n = 21) ♀ × apomictic Waiau (n = 42) ♂ gave rise to a single F_2 plant from which F_7 plants have been raised.

Emasculated florets of F_5 and F_6 Waipara × Waiau have been hand-pollinated with pollen from several sexually reproducing phenodemes and seed has set. Plants have been raised which can be identified from morphological markers as undoubted hybrids, but among hundreds of florets from these hybrids only one seed has set. It would seem that the hybrid Waipara × Waiau is sexual and that apomixis must be quite recessive in character. Hybrids (Waipara × Waiau) ♀ × Otago ♂ have been weak and have failed to flower indicating that imbalance can also occur at this stage.

Further crossing experiments among the sexual phenodemes have been carried out to complete the work on genetic relationships.

4. *Chionochloa* (Mr H. E. Connor)

The genus *Chionochloa* Zotov includes some of the more important tussock grassland species. Interspecific hybridization has been undertaken in an effort to define more clearly the relationships among them. Hybridization has proved simple and since germination problems have been overcome nine interspecific hybrids have been raised. Two interspecific hybrids have flowered and appear fertile.

5. *Sophora* (Dr E. J. Godley)

The main aim of this work is to study the components at present classified under the name *Sophora microphylla*. Collections of seed have been made from populations throughout New Zealand, and seedlings raised from these are scored after twelve months for such characters as leaf size, leaflet number, and growth form (e.g. whether a divaricating juvenile form is present or not). Four plants from each gathering are then planted out in the experimental garden and will be grown to maturity.

Plants from Southern Chile and one plant from Gough Island in the South Atlantic Ocean are being compared with the New Zealand Sophoras.

The following localities have been sampled so far and are listed from north to south.

Sophora microphylla

North Island: Kerikeri; Helensville; Warkworth; Shoal Bay, Great Barrier Island; Whatipu; Lake Waikari; Taupo; Taumarunui; Karioi; 7m. south of Waiouru; 5m. north of Taihape; Ohingaiti; lower Wanganui River; Paremata; Lake Wairarapa.

South Island: Collingwood; Takaka; near mouth Heaphy River;

Tuamarina; Wairau Valley; Lake Rotoroa; Murchison; Maruia; Woodside Creek; 5m. north of Kaikoura; Waiau, near Hanmer; West Melton, near Christchurch; between Raupo and Stony Bay, Banks Peninsula; Rakaia Gorge; Pareora Gorge, Timaru; mouth of Haast River; Lake Wanaka; Lake McKerrow; Lake Wakatipu; Lake Te Anau; Teviot River; Waihopai; Niagara, near Tokanui.

Chatham Island: two collections.

Southern Chile: Frutillar Bajo, Llanquihue; Chepu, Chiloé.

Gough Island, South Atlantic Ocean: one plant.

Sophora prostrata

South Island: Mt Highfield, Waiau; Upper Waitohi River; Waipara River; Rakaia Gorge; Lake Georgina; Lake Tekapo.

Sophora tetraptera

North Island: Frasertown, Hawkes Bay.

6. *Ranunuculus* (Dr F. J. F. Fisher)

Studies recently completed of the dozen or so *Ranunculus* species which are almost entirely confined to the upland slopes of the New Zealand mountains have revealed the existence of a wide range of continuous variation patterns. Certain groups of races previously thought to be taxonomically distinguishable have now been found to be fully intergrading although no evidence has been forthcoming that their intergrading might be the result of recent hybridization.

When intensive field-studies fill out the gaps between previously widely-spaced collections it is not unusual for the taxonomist to be confronted in some degree with such questions of intergrades. When the intergrades occupy an insignificant part of the total geographic range it may be justifiable for them to be treated taxonomically as hybrids, or even in some cases to be ignored altogether. It is however, difficult to justify such treatment when the intergrades occur over a substantial part of the total distribution, and the viewpoint then taken in some Floras leads to the breaking up of this sort of continuous range into arbitrary subdivisions, each with its own type-specimen. In other Floras a different view leads to the provision of a single all-embracing description. The first view implies non-existent discontinuities, while the second is equally unsatisfactory in its failure to describe real differences which exist between populations in spite of their morphological overlap. For the purpose of expressing such geographically complex variation patterns adequately, the ordinary descriptive methods of taxonomy are in any case poorly adapted, and it may be necessary for them to be supplemented with maps and diagrams in order to convey all the information available.

The variation patterns of the New Zealand alpine *Ranunculi* have now been examined in sufficient detail to make it possible to predict fairly accurately in each species the range of forms most likely to be encountered for any particular locality. These patterns differ widely among different species. Thus in *R. insignis, R. sericophyllus* or *R.*

crithmifolius individual populations may be almost uniform yet each species as a whole includes such a wide range that in the past it has been subdivided into several varieties or even species. In other widely variable species such as *R. gracilipes, R. verticillatus,* or *R. buchananii,* the total variation barely exceeds the range in each local population, only the relative incidence of different forms varying geographically. At another extreme, species such as *R. lyallii, R. godleyanus* and *R. nivicola* approach uniformity throughout their ranges.

The demonstration and description of continuous variation in these New Zealand buttercups has not been found to require special innovations for a satisfactory taxonomic treatment: maps and diagrams have been prepared in which continuity and local trends are directly illustrated. Each taxonomic distinction now recognised makes use of a definite discontinuity in one or more characteristics and in this particular group each distinction also possesses a clearcut geographic basis. The subordinate taxa recognised have accordingly been placed at the subspecific rather than the varietal level.

The diversity of variation patterns in *Ranunculus* corresponds to a probable sequence of stages in evolutionary differentation which has been largely, if not entirely, allopatric in nature. There is nothing in either breeding behaviour or in the patterns themselves to suggest that genetic isolation might have been developed by disruptive selection within single populations. From the present distributions it has also been possible to deduce the most probable migrations which followed successive stages of diversification. After an apparently ancient separation into two coenospecific breeding groups, parallel adaptive radiation in each has led to the filling of similar sets of habitats. The two breeding groups are today linked by an allopolyploid (*R. nivicola* 2n = 96) while numerous hybrids also exist between and within each group. All species tested have been found capable of crossing with several others, various hybrid combinations differing widely in relative fertility. Breeding relations of every species except *R. grahamii* and *R. pinguis,* and the chromosome numbers of all except *R. grahamii,* have been determined.

The following is a summary of the recently completed taxonomic revision of the alpine *Ranunculi* of New Zealand. The chromosome numbers of all except *R. grahamii* are given under the heading of breeding groups while the figures in parentheses on the right indicate known hybrid combinations for each species.

Breeding Groups		*Species*	*Hybrids*
I (2n = 48)	1	*R. buchananii*	(3, 4, 7)
	2	(*R. grahamii*) ?	
	3	*R. haastii* (2 subspecies)	(1)
	4	*R. lyallii*	(1, 7, 11, 13)
	5	*R. pachyrrhizus*	(7)
	6	(*R. pinguis*) ?	

		7	*R. sericophyllus*	(1, 4, 5, 12, 13)
		8	*R. verticillatus* (= *R. clivalis*)	(13)
II	(2n = 48)	9	*R. crithmifolius* (2 subspecies) (incl. *R. chordorhizos*, *R. paucifolius*)	(12 ?, 13)
		10	*R. enysii* (incl. *R. novae-zelandiae*, *R. berggrenii*)	(12, 13)
		11	*R. godleyanus*	(4)
		12	*R. gracilipes* (incl. *R. sinclairii*)	(7 ?, 13)
		13	*R. insignis* (incl. *R. monroi*, *R. lobulatus*)	(4, 7, 8, 9, 10, 12)
III	*Allopolyploid* (2n = 96)	14	*R. nivicola* (probably from *R. insignis* × *R. verticillatus*)	

7. Hepatics (Dr Jane Taylor, D.S.I.R. National Research Fellow)

The research work which has been carried out over a period of 21 months, on a morphological, anatomical, and cytological investigation of the subantarctic element of the New Zealand Leafy Hepaticae may be summarized under the following headings: (a) Field work, (b) Laboratory work, and (c) Compilation and interpretation of data.

(*a*) Field work.

The best collecting localities were found in Stewart Island, Fiordland, and Westland. Because of greater ease of accessibility, the majority of the specimens were collected in Fiordland, where the Milford Tracks from the Clinton Valley over the Mackinnon Pass to the Arthur Valley and Sandfly Point, the Doubtful Sound Track from the head of Lake Manapouri over the Wilmot Pass to Deep Cove, and the Eglinton and Lower Hollyford Valleys provided excellent "walking transects".

A first step was to establish the seasonal cycle. It was found that the plants were in an ideal fruiting condition for anatomical studies in May and June. The sporophytes were well developed but still enclosed within the mature calyptrae. Ripe spores for morphogenetic studies of the developing sporelings were most abundant in September-October, while early stages in the embryonic sporophytes which are suitable for the study of developmental morphology were available from October to February. From the cytological standpoint, meiosis was found to occur in most sporophytes in May and June, premeiotic mitoses suitable for analysis, from February to April, while June and September were the best months for mitotic activity in antheridia. Cell division in the leafy apices of the gametophyte probably occurs throughout the year

except during periods of drought. The best activity was observed in April and May. (These observations were made over a period from May 1961 to January 1963).

Materials for anatomical and morphological investigations were fixed in either Formalin Acetic Alcohol or Newcomer's fixative, and for cytological studies in either "Carnoy" or "Newcomer". The latter has the advantage that material may be stored in this fixative for at least 2 years in a refrigerator at 4°C without apparent deterioration. For mitotic metaphases colchicine was found to be the most satisfactory pre-treating reagent. In addition to fixed material, the remaining portions of the plants and plants from the same populations have been collected, dried, packeted, and documented as voucher specimens, in most instances in triplicate (a set for the herbarium of Botany Division, a set for Mrs E. A. Hodgson and a personal set). Several thousand packets have been processed.

(*b*) Laboratory work.

1. Morphological and Anatomical Preparations.

Serial sections (paraffin method) have been prepared and stained using a modification of Sharman's schedule. This method, employing Tannic acid and Iron alum with Safranin and Orange G, gave results which are superior to the standard Chamberlain-Johansen techniques. About fifty permanently mounted slides (out of an estimated 2000 still to be prepared) have been made.

2. Aspetic Culture of young Gametophytes (Sporelings).

Agar slants containing soil-extract and sucrose were inoculated with spores from sterilized mature capsules of species representing nine genera. The cultures were incubated at room temperature. Germination (primarily a photoperiodic response) took place after 10-15 days. At the 2-3 celled stage the cultures were airmailed to Dr R. E. Hatcher, University of Wisconsin. The aim is to work out specifications of the environmental requirements for their rapid and orderly ontogeny (starting from a one-celled haploid spore). External factors in particular have been found to affect the developmental pattern, notably the day-night cycle, light intensity, and medium composition.

3. Cytological work.

Cell division has been studied in the leafy tips of gametophytes (stem apices and leaf primordia) for mitosis, antheridia for mitosis, young sporophytes for mitosis and older sporophytes for meiosis. The main difficulty in dealing with the chromosomes in the leafy tips is the refractory cell-wall. It is essential to obtain preparations in which the intact metaphase plates are out of their cells and lie completely free of cell wall debris. They can then be spread and flattened in one plane. Several methods have been tried in an attempt to either soften or dispose of the cell-wall and still maintain the integrity of the chromosomes.

(*a*) Chemical treatment. The cells do not separate from each other even after hydrolysis in normal hydrochloric acid at 60°C for three hours. All of the chemical methods which have been used for flowering plants are ineffective.

(*b*) Enzymes. Enzymatic methods which were used include treatment with snail (*Helix aspersa*) stomach cytase, pectinase—DeLautour's method, pectinase followed by a proteolytic enzyme (papain and trypsin), the pectinolytic enzyme obtained from *Bacterium aroidea,* extracts prepared by Dr A. Mulcock from cultures of organisms trapped from liverwort plants, or the denatured cell-walls. Dr Mulcock's cultures gave some promising results for specific genera but further investigations are needed.

(*c*) Chelating agents. The sodium salts of E.D.T.A. and H.M.P. with modifications of the methods of Letham and Ginzburg have been used as macerating agents, and a maceration method suggested by Dr M. C. Probine using E.D.T.A. and ammonium oxalate. Cell separation has been obtained but it has not yet been possible to soften or break down the cell-wall without damage to the metaphase plates. Dr Probine has undertaken further investigation of the cell wall (electron microscopy) while a histochemical study is in progress in collaboration with Mr E. J. Beuzenberg and Dr Wicken.

(*d*) Mechanical method. Exploratory work using various types of tissue grinders in an attempt to release the contents of the cells by fracturing the cell walls has been done by Mr E. J. Beuzenberg. This approach (suggested by Dr R. M. Allison) may lead to a useful technique. The restrictions imposed by the "microscopic apical buds" and the diameter of the cells in actively dividing tissue are the chief obstacles.

Time which would have been devoted to karyotype analysis has thus been devoted to problems of technique. From observations made during the course of this exploratory work it has been possible to establish that chomosome behaviour in the liverworts is comparable to that of the flowering plants.

Meiotic preparations also present technical difficulties in the form of oily inclusions within the capsule wall which may effect penetration of the fixative and make it difficult to achieve satisfactory staining of stages of meiosis. A cell suspension technique, devised by Mr E. J. Beuzenberg, gave the most promising results and with refinement the method may lead to a standardized technique.

(c) Compilation and interpretation of data.

The compilation of data proceeds at a pace commensurate with the technical work involved and a considerable amount of laboratory work remains to be done before a synthesis can be anticipated. As facts come to light however, which may make the taxonomist's task easier, they will be published in short papers. Correspondence with taxonomists concerning the delimitation or re-delimitation of genera and

families has lead to the following papers which were prepared during the course of this work—

1. "Some Morphological Characteristics of the Female Gametophyte of *Lepidozia apiahyna*" Bryologist 64 (4) : 351-355, 1961. 2. "Intercalary Branching in the Lepidoziaceae" Journ. Hattori Bot. Lab., 25, 102-106, 1962, and 3. "The Perigynium and Sporophyte of *Geocalyx novae-zelandiae*", which has been accepted by the editor of the Journal of the Hattori Botanical Laboratory. In these instances sufficient data were available to show that discontinuity in morphological diagnostic criteria did not exist in nature.

As a general background of information, it was necessary to compile a card index to the New Zealand species of liverworts. (In Part II of Hooker's Handbook of the New Zealand Flora (1867) a part was devoted to the liverworts, with an appendix by Mitten. None of the Floras since that time has included the liverworts.) The card file is a useful reference tool in the filing of herbarium specimens and Miss B. H. Macmillan has undertaken the preparation of a duplicate, taking advantage of the literature available in my private library to "double check" and add further documentation in many instances. The work of Miss Macmillan could lead to a valuable publication in the form of a check list to New Zealand Hepaticae.

There is no particular reference to the liverworts in the Handbooks of the National Parks and the group has not been dealt with in the Post Primary School Bulletin Series. This stimulated the idea to select specimens, during the course of routine collecting, which could be used for a series of photographic studies by Mr A. P. Underhill. It is anticipated that these will be published, and I have undertaken to provide a concise explanatory text to Mr Underhill's forthcoming publication.

Acknowledgements.

I should like to express my deep appreciation to the Department of Scientific and Industrial Research, New Zealand for the award of a National Research Fellowship which has enabled me to carry out this work.

The help of the entire staff of the Botany Division is deeply appreciated and I am especially grateful to Dr J. B. Hair and Mr E. J. Beuzenberg who have given so much time and made such valuable contributions to the solution of the many problems relating to cytological technique. The interest and help of Dr A. D. Thompson, Dr R. M. Allison, Dr M. C. Probine, Dr A. P. Mulcock and Dr Wicken is gratefully acknowledged. I owe a special debt of gratitude to Mrs E. A. Hodgson for her taxonomic help and to friends whose help and companionship in the field made the acquisition of specimens possible.

8. Experimental Morphology (Dr F. J. F. Fisher)

In earlier studies depth of lobing of leaves of *Ranunculus hirtus* was found to be inversely proportional to the temperature of the primordia.

Development at the primordial stage is to a great extent a matter of marginal cell-divisions. Changes in the depth of lobing are thus largely attributable to changes in the relative amounts of cell-division at different parts of the embryonic leaf-margin. It is now postulated that a preferential channelling of essential growth substances along provascular strands differentiated at an early stage causes marginal tissues near the ends of the provascular zones to be favoured at the expense of tissues in the intervening sinus zones when temperature limits the supply.

Since the key-process appears to be the formation of the provascular tissues, manipulation of their development offers a potentially fruitful line of attack. Precision autoradiography using tritium-labelled substances, together with the polarised application of growth-regulators *in vivo* and *in vitro,* is being developed for this purpose. A survey of other physical methods which might be used for the detection in living tissues of reaction-diffusion wave-fronts involved in morphogenesis, has also been initiated. These studies are being carried out in collaboration with the Plant Physics Unit, Dominion Physical Laboratory, Lower Hutt.

9. Sex Expression (E. J. Beuzenberg in collaboration with K. Vizer)

Transitional stages between normal anthers and carpelloid structures are being studied in wheat. The distribution pattern of the various degrees of carpellody corresponds with the morpho-genetical gradients normally found within a floret, within a spikelet and within a spike. Experiments with growth substances on carpelloid and on normal wheat are now in progress, and will be extended to *Callitriche* and *Marchasta* in which intermediate sexual structures occur also. Data from the induced modifications may be of value in elucidating some physiological processes underlying the differentiation of the apical meristem into vegetative, male and female organs.

HORTICULTURAL PLANTS

(Mr W. R. Sykes)

Studies on the native and adventive plants have now been supplemented by the commencement of research upon the cultivated plants. This is a vast project in view of the varied topography and climate of New Zealand. The emphasis of this work is upon native and exotic plants which are considered as having ornamental value. The introduction of garden plants from local and overseas sources has been going on more or less continuously since the earliest days of European settlement.

Work at Lincoln has begun upon the woody ornamental plants; the basis being the building up of a herbarium of material collected in private, public and commercial establishments. Concomitantly, the library of relevant literature is being gradually supplemented. Preliminary collections have been made in the population centres of Whangarei, Auckland, New Plymouth, Wellington, Nelson, Timaru, Dunedin and especially the mid-Canterbury area centered on Christchurch. The last named city is fortunate in possessing the finest Botanic Gardens in the Dominion with a large collection of north temperate trees and shrubs. In other centres with more congenial climates there seems to be a modern trend towards the greater use of southern Australian and South African plants as cultivated ornamental subjects.

As an adjunct to the herbarium the compilation of a punch card index of cultivated trees and shrubs has begun. On each card the essential details of each plant, such as family and country of origin, are recorded, along with its distribution in New Zealand. It is hoped to ascertain the pattern of distribution for each species recorded and then to investigate the reasons for the results obtained.

In co-operation with the Royal New Zealand Institute of Horticulture work is being undertaken in the drawing up of an international register of all *Leptospermum* and *Hebe* cultivars. Living collections of the cultivars of these two genera are being built up at the Christchurch Botanic Gardens and at Lincoln. Assistance on the Nomenclature Committee of the above Institute has been given. The purpose of this committee is to check the nomenclature of *Hebe* and *Leptospermum* cultivars especially, but also to give advice to the horticultural world and other interested people upon nomenclature matters in general. Lectures to local horticultural societies upon ornamental Asiatic plants have been given in the North and South Islands.

ADVENTIVE PLANTS

(Mr A. J. Healy)

1. Taxonomy: Work has continued on the projected Adventive Flora of New Zealand and on the more popular weed handbook.

2. Identifications: A wide range of adventive plants has been identified for officers of State Departments (especially the Farm Advisory and Horticulture Divisions, Department of Agriculture), local authorities, agricultural firms and private individuals, and useful data on distribution and abundance incidentally secured. The inquirer receives not only the name of the plant submitted, but in addition, information as to general characteristics, status as a weed or potentialities as a weed,

and whether "noxious" under the Noxious Weeds Act 1950. An increasing amount of work has been done for officers of other Divisions of D.S.I.R. at Lincoln. The Division is regarded as the authority for identifications of adventive plants in New Zealand.

3. Applied Work:

(*a*) Importation of Plants: From time to time opinion is sought and recommendations made to the Department of Agriculture (Horticulture Division) as to the desirability or otherwise of permitting entry of particular species into New Zealand under the provisions of the Introduction of Plants Act 1927; many of the species submitted for comment are considered undesirable entrants because of their botanical characteristics and potential weediness.

(*b*) Introduction of Weeds etc.: Work has been continued on means of entry of weeds into New Zealand from overseas and dispersal of weeds within New Zealand. One investigation involved entry of seed in mud on boots from New Caledonia; germination of seeds in the mud on sterile media yielded 353 plants, representative of some 30-odd species, the majority being grasses and sedges. The total number of species is not yet known, as some plants have still to flower and fruit.

(*c*) Prevention of Spread of Weeds: Lectures have been given to farming and other organizations on spread of weeds generally in the country and methods which could be adopted to reduce the dangers. Lectures on nassella tussock (*Nassella trichotoma*), showing how to distinguish it from macroscopically similar native tussocks and discussing its ecology and agricultural significance, have been given to County Councils and Federated Farmers in lower North Canterbury, Banks Peninsula and North Otago, and to the Department of Agriculture, Roxburgh, Central Otago; field days have been attended and addressed on Banks Peninsula and in Central Otago.

(*d*) Noxious Weeds: Opinions have been given to the Department of Agriculture (Farm Advisory Division) on the question of adding species to the schedule of the Noxious Weeds Act 1950, and advice given to Noxious Weeds Inspectors of local authorities on particular aspects of the Act.

(*e*) Weeds of Lawns and Greens: Lectures have been given to Greenkeeper's organizations on weeds of turf and their identification, ecology and spread, and practical advice on identification given at field days. To assist these organizations in identification of turf weeds, a series of plots of perennial matweeds (*Centella, Cotula, Dichondra, Hieracium, Hydrocotyle, Nertera, Oxalis, Pratia*) have been laid down in the lawn of the Division's headquarters.

4. Publications: Papers on identification, distribution and abundance of thistles, clovers and dandelions and related weeds have been published; these were intended for use of agricultural advisory and related workers, and in the case of the clover paper there has been a steady demand for copies from overseas.

BOTANICAL ILLUSTRATIONS

(Mr K. R. West)

In the last three years some 400 drawings have been completed. Line drawings, diagrams and maps have been made for the following papers or bulletins. "Synopsis of the Grass Sub-Family Arundinoideae", (V. D. Zotov); "Dandelions and related Rosette Weeds in New Zealand", (A. J. Healy); "Identification of Thistles and Thistle-like Weeds", (A. J. Healy); "The Identification of Clovers in New Zealand", (A. J. Healy); "Kea Point Nature Walk", (H. E. Connor and K. R. West); and "A Revision of the Alpine Ranunculi of New Zealand", (F. J. F. Fisher).

Line drawings and displays were prepared for the official opening of the new building, and a mural has been completed for the entrance foyer.

VEGETATION SURVEYS

1. Northern off-shore islands (Mr I. A. E. Atkinson).

In the smaller off-shore islands New Zealand has an irreplaceable reserve of her indigenous lowland and coastal plants and animals. These islands are varied in plant covering and offer excellent opportunities for study of interactions between plants, animals and physical factors of the environment; but many islands have been modified by the Maori occupation or damaged by introduced mammals. The present survey is being conducted in co-operation with the Wildlife Branch, Internal Affairs Department, to ascertain what plants and animals remain on these islands and to decide what conservation measures are needed.

A general account of the inner islands of the Hauraki Gulf has been completed and a more detailed investigation made of Motuhoropapa Island. Assistance was given to a survey of Little Barrier Island, one of New Zealand's most significant flora and fauna sanctuaries. Detailed surveys have been made of Cuvier Island and several of the smaller islands of the Mercury group.

2. Vegetation-soil survey of Tongariro National Park, North Island (Mr I. A. E. Atkinson).

The purpose of this survey is to map and describe the various vegetation-soil systems present within the Park, to describe the changes going on within these systems, and as far as possible to ascertain the reasons for these changes. Apart from its scientific interest some of the knowledge gained can be applied to the problem of maintaining the

natural landscapes of the Park as close as possible to their original condition.

Some degree of subjective judgement is invariably present in mapping vegetation. In an effort to reduce this subjectivity, a new procedure for mapping has been developed. Other problems which are receiving attention during the survey are the development of alpine terraces, processes of erosion, and the spread of the introduced lodgepole pine (*Pinus contorta*) which threatens to alter completely the character of some parts of the Park.

3. Soil survey of Taita Experimental Station, North Island (Mr I. A. E. Atkinson).

This is a detailed survey being carried out in co-operation with the Soil Bureau of D.S.I.R. the purpose of which is to map the soils of the 200 acres of hill country at the experimental station. Knowledge of the pattern of soil variation is necessary in siting various experimental projects that are being initiated. It is also hoped that the project may throw some light on the origin of the soils in the Taita district.

4. Vegetation patterns in North Island mountains (Mr A. P. Druce).

Field work has been continued at intervals to fill in gaps in our knowledge of the vegetation of North Island mountains. Particular attention has been paid to the distribution pattern of beech forest, for there are many suitable areas besides Mt Egmont from which beech forest is absent. Investigations of transitional areas between beech forests and other forests has revealed a universal trend towards replacement of non-beech species by beech species. A typescript entitled "Mountain Vegetation of the North Island" has been prepared and is on file.

5. Hurumua Scenic Reserve, North Island (Mr A. P. Druce).

Hurumua Scenic Reserve was established for the purpose of safeguarding the only known surviving stand of *Pittosporum obcordatum,* and is situated in farmland on the river flats of the Wairoa River about three miles north-west of Wairoa. A report was requested from Botany Division by Lands and Survey Department. The reserve consists of a stand of forest dominated by kahikatea and surrounded by grass containing scattered clumps of bracken, trees and shrubs. The survival of *Pittosporum obcordatum* in the reserve seems assured; during the investigation plants of all sizes from seedlings to adult shrubs, ten or more feet high, were seen. It was recommended that three adventive species in the reserve, blackberry, hawthorn and honeysuckle, be controlled at regular intervals. The report is filed at Botany Division.

6. Egmont National Park, North Island (Mr A. P. Druce).

The principal aims of this survey are three in number:

(*a*) To describe and map the present vegetation of the park, which includes the Pouakai and Kaitake ranges.

(*b*) To attempt to relate the nature of the present vegetation to the available plants and animals, to the environment (climate, soil parent material, topography, ground water), and to historical events, especially those of a catastrophic nature. The latter include eruptions and natural fires, floods and associated landslides and fans, wind-blown salt, introduced browsing animals, man's activities, all of which are of great importance in the area.

(*c*) To compile a check list of the flora of the district, to record the distribution of each species, and to collect voucher specimens for the Botany Division herbarium.

The survey is nearing completion: much of the vegetation has been sampled by one method or another; the majority of the vegetation types have been delimited and named; working hypotheses have been deleloped to account for the general pattern of the vegetation in relation to the various factors mentioned above (excepting flood damage which remains difficult to explain in its present site); the second approximation to a check list of the higher plants (clubmosses, ferns, gymnosperms, flowering plants) has been compiled and photocopied (the list contains 530 indigenous and 70 adventive species); voucher specimens of almost all of these have been placed in the herbarium.

Sampling of the vegetation has been by two principal methods:

(*a*) Description of small areas in which special emphasis is given to structure and *overall* composition (see "An Empirical Method of Describing Stands of Vegetation", *Tuatara* Vol. 8, No. 1).

(*b*) Traverses in which special emphasis is given to *canopy* composition. A point analysis of crown cover is made at 100 stops along a line or loop, the stops being made every ten paces in forest and every five paces in scrub. Summing up then gives the percentage canopy composition, e.g. at 2000 ft, N.E. slopes of Egmont, rimu 3%, northern rata 4%, kamahi 64%, mahoe 4%, putaputaweta 4%, broadleaf 4%, tree-fern 6%, miscellaneous 5%, gaps in the canopy (above seven feet) 6%. A description and evaluation of the point method, as adapted for forest and scrub, is being prepared. After a trial period, involving about 4000 points, the method has been found practicable, avoids bias to a large extent, but takes time—one to two hours per 100 points.

The survey has shown that it is no exaggeration to say that virtually all of the vegetation in the park is unstable at the present time, i.e. comparatively rapid changes are taking place. Some of these changes, for instance the change in the age distribution of rimu, cannot be accounted for, but many others can. The principal recent events initiating change are:

(*a*) The Burrell eruption, of 308 years ago, which destroyed by impact and burial a portion of the vegetation on the south-east side of Egmont and added up to 18 inches of andesitic pumice-gravel and ash to the soil.

(*b*) The Newall eruption, which was probably contemporaneous with

the Burrell; it destroyed, by heat as well as by impact and burial, a narrow segment of the vegetation on the W.N.W. side; deposited up to four feet of sand, gravel and stones, but no pumice; started a forest fire which spread round the north-western slopes of the Pouakai Range; and led to the formation of a very large colluvial fan between the Okahu and Stony rivers on the west side.

(*c*) At least two exceedingly large floods, probably more, which occurred between 70 and 150 years ago. There was renewed fan building and much of the vegetation that had developed since the Newall eruption was partly or wholly destroyed. Near the Stony and Okahu rivers flood waves overturned trees in broad swathes through the forest in a manner not fully understood.

(*d*) A continuing series of debris avalanches on the steep slopes of both Egmont and the Pouakai Range; and numerous rock falls from the laterally eroding lava flows of Egmont.

(*e*) Repeated salt damage to the forest canopy by strong winds from the south-west quarter, particularly to the emergent trees northern rata and kaikawaka which show widespread partial or complete crown death.

(*f*) The introduction of browsing animals. The subcanopy vegetation of most of the forest and scrub in the park has been very seriously depleted by goat browsing. Without regeneration of canopy species, gaps resulting from death or windthrow are not being filled adequately, and unless the number of goats is greatly reduced in the future much of the vegetation will be degraded to lower types, such as pasture, sedge land, horopito scrub and tree-fern forest. In addition goats are leading to direct death of the scrub canopy in a number of places by barking and browsing combined. Serious but less extensive damage has been, and continues to be caused by opossum browsing of canopy species, particularly kohekohe, kamahi, fuchsia and wineberry, to a lesser extent five-finger, leatherwood and other species. Greatest damage is apparent where these species do not form a major part of the canopy. Kamahi is normally a dominant species and in these circumstances appears untouched, but where it constitutes only a small portion of the canopy, as on the lower slopes of the Kaitake Range and on the south-eastern slopes of Egmont, much of it is dead. It is not known if opossums have contributed to the crown damage of northern rata; they do not appear to have been of prime importance.

A general account of the vegetation of the park has been written for the forthcoming Egmont National Park Handbook.

7. Nelson Lakes National Park, South Island (Mrs M. J. A. Bulfin).

Vegetation surveys have been made along the full length of the Travers River Valley and up to the Travers Saddle. Four areas along the St Arnaud Range have been sampled at 5500ft.-6100ft., and the Arnst Basin, in this range but facing towards the south, has been investigated. The Travers Range has been worked over from Lake Rotoiti to Hinepouri Tarn and sampled at Hopeless Basin, Mt Travers

and Travers Saddle. Several species reach their northern limit along this and the St. Arnaud Range including *Chionochloa crassiuscula, Chionochloa oreophila* and *Ranunculus sinclairii.* Black Hill and some of the adjacent country at the northern end of Lake Rotoiti which differs geologically from the rest of the Park and which supports a different vegetation, either by nature or modification, has been partially worked over. A permanent quadrat has been set up on the burnt northern face of Mt Robert and the face was mapped generally one year ago to watch regeneration trends. A photographic record of the quadrat and face has been started.

Surveys have been made at several places in the mixed podocarp-beech forest around Lake Rotoroa, on the deltas on both the Sabine and D'Urville Rivers, to the head of the west branch of the Sabine River and also for a few miles up the east branch. One short trip was made to the head of the east branch from Canterbury but the weather was too bad for any detailed work to be done although some photographs were taken. The D'Urville River has been mapped for a distance of about 8 miles from the lake. Bad weather and a flooded river has hampered work in this area. In this catchment the only summit looked at so far is Mt Misery 5252ft. where one day was spent sampling the various associations.

2245 specimens of cryptogams and phanerogams have been collected. The moss collection of 98 species has been identified by Mr K. W. Allison of Dunedin and has been deposited in the herbarium. The second collection of a new species is included.

A photographic record has been kept in black and white and in colour.

Forest at lower levels in the Park (1500ft.) is mixed beech-podocarp. Around Lake Rotoiti (2000ft.) and in its catchment the forest is beech. Small, local pockets of *Libocedrus bidwillii* occur here. The bushline varies from ca 4800ft. to 5200ft. Vegetation above the bushline is rich floristically. A number of species extend to 6000ft. and isolated plants are to be found in pockets up to the highest point, (*Gentiana* sp. in the summit rocks of Mt Travers 7671ft.).

8. Subalpine forest and scrub (Dr P. Wardle).

This project was commenced at the Forest and Range Experiment Station in 1957, and transferred to the Botany Division in 1960. To date, the major efforts have been towards a primary ecological survey. Ecological accounts have already been published for subalpine vegetation in the Hokitika Catchment and the Tararua Range. The broad vegetation pattern is now clear, though there are still some gaps to be filled. Plant communities have proved to be very diverse, reflecting, partly, the sharp variations in the mountain habitats, and partly, the discontinuous and localised distribution of the dominant species. In fact, minor species are often proving to be a better guide to community inter-relationships than major species.

The autecology of representative subalpine shrubs and trees is also

being studied, and a paper dealing with growth habits has been published. This paper emphasises the generally slow growth rate, the well-marked seasonal periodicity in growth, and the universal tendency to multiply vegetatively through layering of prostrate branches. In a current programme, resistance to refrigeration is being compared among several native species and the hardy exotic tree, *Pinus contorta.*

A third part of the project is the investigation of the causes of the upper forest limits ("timber-line"). So far, this has consisted mainly of reconnaissance, but transplanting experiments with mountain beech (*Nothofagus solandri* var. *cliffortioides*) were commenced in 1959. These experiments point strongly to the importance of the length of the frost-free period, in setting the upper limit of this species. At present a year's study leave is being taken at the University of Colorado, with a view to comparing the very high (11,000-12,000ft.) timber-lines of the Colorado Rockies with those of New Zealand.

The continued co-operation in this project by the staff of the Forest and Range Experiment Station has been much appreciated.

9. Tussock Grassland Studies, South Island (Mr H. E. Connor).

Comparative studies of the economically and hydrologically important South Island tussock grasslands have been continued especially in Canterbury. Tall-tussock grasslands of the Mackenzie Basin have been examined in detail and floristic analysis shows that in the southern parts there is a continuation of the grassland described in Connor (1961) for inland North Otago, while the northern and eastern mountains carry grasslands differing floristically from those in the south and from those on the seaward facing side of the ranges.

It is notable in much of the low-tussock grassland in Canterbury that the response of these natural grasslands to the drastic reduction in rabbit population shows up in the number and size of small fescue-tussocks (*Festuca novae-zelandiae*) and the occurrence in open places of species such as plume grass (*Dichelachne crinita*) and blue wheat-grass (*Agropyron scabrum*).

10. Survey of Fresh Water Plants (Miss R. Mason).

Field trips have been made to the Hauraki Plains and western Bay of Plenty, Hawkes Bay, South Canterbury and Otago, Rotorua and Bay of Plenty, and various parts of Canterbury and Marlborough. Some 2400 specimens of water, swamp, and bog plants were added to the herbarium in the course of the survey and much information gained on plant distribution.

An account was published of the three members of the tribe Anachariteae, Hydrocharitaceae, that occur in New Zealand. *Elodea canadensis* has been in the country since 1868, introduced with trout ova, and is now widespread though not universally present in waters. *Egeria densa* and *Lagarosiphon major,* both grown as aquarium plants, are known to have been established in the wild since 1946 and 1950 and are restricted in their distribution.

11. Mapping Scheme (Dr P. Wardle).

Several countries, notably Great Britain, have intensive schemes for mapping the distribution of their entire vascular flora. New Zealand has not the resources to undertake such a scheme, yet the lack of precise information on the distribution of even our commoner species is a serious handicap. To see if this difficulty could be overcome, staff of the Division sent gridded maps (scale 8m/1inch) to botanists throughout the country, and asked them to enter all their *reliable, first-hand* information on the distribution of silver beech (*Nothofagus menziesii*) and kamahi (*Weinmannia racemosa*). The results were very encouraging, and it is suggested that the methods will be useful for future studies where information on the distribution of a species is required.

12. Conservation (Mr I. A. E. Atkinson).

An analysis has been made of the potential uses of natural stands of vegetation and soil both in basic and applied scientific studies. A scheme has been suggested showing how a system of soil and vegetation examples representative of a wide range of environments could be established within New Zealand.

A particular problem is that of the preservation of examples of some of New Zealand's unique communities at present fast disappearing under more intense forms of land use. Reports have been prepared on the unique communities of the Chatham Islands and on the *Sporodanthus* bogs still surviving in the Waikato district.

VEGETATION AND ANIMALS

1. Northern off-shore islands (Mr I. A. E. Atkinson). An analysis has been made of the effects of goats on the vegetation of Cuvier Island, and preliminary sudies have begun on the effects of rabbits on some of the smaller Mercury islands.

2. Kourarau, North Island (Mr I. A. E. Atkinson). This is a co-operative project with the Animal Ecology Division of D.S.I.R. A detailed study is being made of a rabbit population within an enclosed 21 acre area of hill-country sheep pasture at Kourarau, 15 miles east of Masterton. During this period work has been concerned with finding an adequate method for following changes in pasture composition.

3. Travers Valley, South Island (Dr E. J. Godley and Mr I. A. E. Atkinson). This area is the site of observational work on introduced animals by the Animal Ecology Division, D.S.I.R. and members of the Forest Research Institute. A report on the vegetation was made and is filed at Botany Division.

4. Molesworth, South Island (Dr L. B. Moore). Brief visits were

made in February of 1961 and 1962, the latter to continue the series of three-yearly photographs from fixed points begun in 1944.

5. Motunau Island, South Island (Miss R. Mason). Observations continued on the vegetation of this small bird sanctuary off the North Canterbury coast. After the rabbits had been reduced to a very low number they were unfortunately allowed to increase considerably, before being again reduced to a very few. This temporary increase did not halt, but slightly slowed down the changes which had begun in the vegetation. The cover of silver tussock, *Poa caespitosa,* decreased where it was very badly damaged, and increased where damage was only light. The spread of *Disphyma* (*Mesembryanthemum*) *australe* and the spread and increase in size of plants of *Hordeum murinum* were spectacular, and there was a great improvement in growth of plants of *Urtica ferox*. Some herbaceous plants, e.g. *Urtica urens* declined in numbers, others increased or were probably newly established. The almost pure bracken patch changed towards a mixture of bracken and tussock.

An account of this island is planned in co-operation with members of the Soil and Animal Ecology Divisions, D.S.I.R.

SUBANTARCTIC BOTANY

(Dr E. J. Godley)

General. An account of botanical researches in the subantarctic and Antarctic is completed up to the time of publication of J. D. Hooker's "Handbook of the New Zealand Flora".

South American sector. Identification continues of the specimens gathered during the Royal Society Expedition to Southern Chile in 1958-59, and sets are being distributed to the British Museum (Natural History) and the National Museum, Santiago. The lichen collection is being studied by Mr P. James of the British Museum. The stage is almost reached when papers can be prepared on vegetation and geographical distribution, and these will be preceded by an account of the botanists' itinerary.

New Zealand sector. The collection of flowering plants and ferns made by members of the war-time Cape Expedition to Auckland and Campbell Islands is being studied. A separate report on the grasses is being made by Mr V. D. Zotov.

January 1-30, 1961 was spent on Campbell Island in company with Mr V. D. Zotov and Dr F. J. Fisher of Botany Division and three other scientists. A vegetation map of the island was prepared and additions to the florula collected.

December 26, 1962 to January 20, 1963 was spent at Ranui Cover,

Ross Harbour, Auckland Islands in company with Dr F. J. F. Fisher, Botany Division, Mr P. James, British Museum and eleven other scientists. A vegetation map was prepared of the off-shore islands and the northern half of the main island as far south as Tandy Saddle. New records of plant distribution have been made for the island.

POLLEN MORPHOLOGY

THESE STUDIES are essential for pollen analysis, and are useful adjuncts to taxonomy. There is a pollen collection of over 4,000 slides at the Division.

The main work has been on certain families for the "Atlas of New Zealand Pollen Types (Dicotyledons)" planned by Dr Lucy M. Cranwell of Tucson, Arizona. A detailed study of Umbelliferae pollen and a somewhat less detailed account of Compositae pollen has been completed. Study of the Umbelliferae pollen has been specially interesting and in the case of *Anisotome* two pollen types were observed. These differ in the nature of the pore and in furrow length, and one of them is clearly similar in morphological detail to the pollen grains of *Angelica* species.

QUATERNARY HISTORY OF THE FLORA

(Mr N. T. Moar)

New Zealand:

1. No Man's Bog, N.E. Ruahine Range. Several peat profiles have been sampled from this mire which lies at 4,500 ft. on the north-east plateau of the Ruahine Range. Mr N. L. Elder, who had earlier investigated the site, stated that pumice layers similar to those already reported from the north-west were present at different levels in the peat. He had also collected wood samples lying in close contact with the two most characteristic pumice layers, the Taupo pumice and the Waimihia pumice, for radio-carbon dating. Because the pumice layers provided the means to correlate pollen diagrams from widely separated areas in these mountains two complete profiles have been examind. Although the wide-spread trend towards the increase in frequency of *Nothofagus* pollen at the expense of *Podocarpus* pollen was recorded, the marked increase in *Dacrydium bidwillii-biforme* pollen was not detected. In this respect the two areas are not comparable and it is possible that such differences may be related to variations in forest composition.

2. Crooked Mary Creek, Palmers Road, near Rahu Saddle. Pollen analysis from this site, 180cm deep, shows several points of interest.

(*a*) High frequencies of *Dacrydium bidwillii-biforme* pollen, a feature of the lower half of the profile, are replaced abruptly at about 110cm by equally high values of *Nothofagus* pollen which are maintained throughout the upper part of the profile. A radiocarbon date from a peat sample a few centimeters above this level indicates that the change occurred at about 4500 years ago.

(*b*) There is a rapid increase in the frequency of *Podocarpus* pollen at 140cm for which there is a radiocarbon date of 9820 $\pm$ 155 years B.P. Thereafter *Podocarpus* values decrease slowly to about 10% at the top of the profile.

(*c*) It is worth noting that pollen of *Nothofagus menziesii* occurs more frequently in the upper half of the profile and that *Phyllocladus* pollen is much more frequent in the lower half of the profile.

The remarkable interplay between *Dacrydium* and *Nothofagus* pollen may perhaps be interpreted as an expression of a reaction to local factors and the changes in *Podocarpus* a reflection of a more widespread change overshadowed by local changes.

South America:

Peat profiles collected by Dr E. J. Godley during the Royal Society's visit to Southern Chile in the summer of 1958-1959 were available at Botany Division for pollen analysis. Two of these, one from Puerto Williams, Navarino Island and one from the Cordillera San Pedro, Chiloé have been completed and in both there are high values of *Nothofagus* pollen. *Podocarpus* pollen persists in low frequencies throughout the San Pedro profile whereas it is absent from the Puerto Williams samples. The persistent high frequencies of *Nothofagus* pollen suggest that only the latter part of the Post-glacial history of the areas concerned is recorded in these profiles.

Britain: (This research is being undertaken at the Botany School, Cambridge University.)

The changes in vegetation in response to fluctuating climatic conditions since Late-glacial times are well documented in Britain. In Scotland vegetational history is known to fit broadly into the established pattern of change, but in some districts the details are less well known than in England or Wales. Because of this, sites in the south-west and north-west of Scotland are being investigated. Since it was necessary to obtain cores influenced as little as possible by local mire vegetation, sites were sought in in-filled kettle-holes of no great area in which the pollen rain could reasonably be expected to be representative of the region investigated. In such sites Late-glacial sediments could occur, whereas on blanket bogs or on raised bogs one might search in vain.

The Late-glacial period in Britain, and in north-west Europe generally, is characterised by a period of climatic amelioration, the Alleröd

(Zone II), to which the vegetation responded so markedly that its expression can be detected in pollen analysis of all Late-glacial sediments. A silty organic deposit, often about 30cm thick, is the characteristic deposit of this time in Scotland. Lasting about 1000 years, the Alleröd is notable, especially in southern areas of Britain, for a considerable increase in the frequency of *Betula* pollen and by the appearance of the pollen of such mildly thermophilous plants as *Thalictrum* and *Filipendula*. This period was followed by colder conditions during which time (Zone III) solifluction processes were active and tree pollen was largely replaced by the pollen of plants such as grasses, sedges and Compositae. During Zone III, equivalent to the Younger Dryas deposits of north-west Europe, the climate seems to have been somewhat less severe than during the period preceding the Alleröd, Zone I (Older Dryas).

In Scotland where the cold periods were considerably more severe than in many parts of England Zones I and III are represented by layers of soliflucted clay which are sometimes of considerable thickness. Although such layers are usually unproductive of pollen, a short sequence of samples from silty organic deposits from the banks of the River Annan in Dumfriesshire yielded enough pollen for statistical treatment. The pollen counts do not contradict a radiocarbon date from the site which indicates that the sediments were laid down during Zone I.

Alleröd deposits in Scotland are relatively rich in pollen, but unlike similar deposits from southern districts, there is no marked increase in *Betula* pollen. Indeed, tree pollen frequencies are so low that it may be inferred that the vegetation was an open tundra through which there were scattered shrubs of dwarf birch (*Betula nana*), dwarf willows (*Salix* spp.) and juniper (*Juniperus*). From a site at Bigholm Burn in Dumfriesshire, at about 700ft. above sea-level, an organic layer overlying blue clay and covered by several feet of solifluction gravels has been investigated. The pollen spectrum suggested an Alleröd age for the deposit and this has since been confirmed by a radiocarbon date. Within the gravels there is included a layer of peat which on the basis of pollen analysis also appears to be of a similar age. If this is the case the included peat may have been redeposited by solifluction movements, but until a radiocarbon date is available no definite conclusion can be drawn as to the age of this layer.

Pollen sequences have been obtained from Zone III sites in coastal south-west Scotland and another has been found in silty layers overlying the solifluction gravels at Bigholm Burn. The pollen spectra from these layers suggest that during Zone III the plant cover was more open than during Zone II and that shade-intolerant plants such as *Rumex acetosella* and *Artemisia* spp. were important elements in the flora. At Bigholm Burn pollen frequencies of *Koenigia islandica* were relatively high; this pollen has been recorded from various Late-glacial sites in the north of Britain, but it is unusual to find it in such

numbers as at Bigholm Burn. The present habitat of this plant is that of damp, base-poor rocks in a few localities on the Isle of Skye and Mull.

It is known that moraine in the Perth-Aberdeen area is correlative with Zone I. It could be inferred that Zone I moraine should be found in the south-west of Scotland within the boundary delimited by Zone I deposits and centered on the Southern Uplands. No conclusive evidence of such a moraine has been discovered, but if the underlying clay at the Bigholm Burn site is equivalent to Zone I it is possible that Zone I moraine had its greatest extension in this area at an altitude higher than 700ft. Such comment is speculative, but there is more convincing evidence that corrie moraines in the Southern Uplands may be equated with Zone III glaciations. A brief examination of stoney clays at the base of one profile sampled behind such a moraine suggests that deposition began during a period transitional between the Late-glacial and the Post-glacial. A complete pollen analysis is to be made of one such profile.

Late-glacial deposits in north-west Scotland have not been discovered during the present investigation although a problematical one is known from Loch Droma, near Ullapool. This site is now buried beneath an hydro-electric dam.

The opening of the Post-glacial period in Britain is marked by a rapid increase in *Betula* pollen, and in this respect Scotland is no exception. In the south-west and north-west coastal areas of Scotland, however, there are features in the post-glacial which differ from those in other parts of Britain. A pollen diagram from the south-west indicates that *Betula* was the dominant forest element until the Post-glacial thermal maximum when *Quercus* and *Alnus* began to replace it. *Alnus* pollen does not increase rapidly in frequency at this time as in many other parts of Britain, but increases slowly from the early post-glacial to its maximum in Zone VII, and in this respect it may be compared with the behaviour of *Alnus* in Ireland. In the north-west of Scotland it is evident that *Betula* was the main forest forming element throughout the post-glacial, whereas the pollen of *Quercus* and *Alnus,* present in low frequencies in the early Post-glacial, show no marked change throughout the period.

It is clear that there has been a regional differentiation of the vegetation in Scotland which is more marked than in most parts of England. The diversity of land-forms and geological structures in Scotland, together with marked climate differences between different areas, suggest that such a differentiation is valid.

GENETICS

Our main research is on the breeding systems of native plants.

1. Native Grasses (Mr H. E. Connor)

The unique case of gynodioecism in the Gramineae reported by Connor and Penney (N.Z. J. Sci. 1960) in *Cortaderia richardii* (Endl.) Zotov (*Arundo richardii* Endl.) has been investigated further, particularly the frequency of the two sex forms in natural populations. Functionally female plants occur in proportions varying from 24 to 52% of the plants, though in one large population in South Canterbury only the hermaphrodite form was recorded. Gynodioecism has now been observed in the three indigenous species of *Cortaderia*. Controlled crossing and selfing experiments have been conducted to assist in the determination of the genetics of gynodioecism in self-compatible *C. richardii,* and work is in hand to estimate what, if any, selective advantages this breeding mechanism has in the genus.

The breeding system in *Chionochloa*—the snow tussock—apart from the record that *C. rigida* is somewhat self-fertile (Connor 1960), is unknown. Selfed and open-pollinated progenies of six species are being grown to determine the effects of inbreeding.

Routine investigation of breeding systems in the indigenous Gramineae continues.

2. *Fuchsia* (Dr E. J. Godley)

Male-sterility in *Fuchsia procumbens* appears to be simply controlled by a dominant gene, but the variable expression of female-fertility in hermaphrodites (in contrast to its invariable expression in females) calls for an investigation into the possible genetical modification of the expression of female-ferility (Godley, N.Z. J. Bot., 1963). Experiments are planned to select for high and low expression of female-fertility in progeny derived from a single hermaphrodite plant.

In the coming season crosses and selfings will be made in *Fuchsia excorticata,* a gynodioecious tree, to determine the genetical basis of male-sterility. An answer may not be available for ten years.

3. *Epacridaceae* (Dr E. J. Godley)

The possible occurrence of a self-incompatability system in *Pentachronda pumila* was mentioned in the previous Triennial Report. Since then controlled crosses and selfings have been made, and the plants used have been found to be self-sterile and reciprocally cross-fertile. A study of pollen-tube growth will be made in the coming season.

It was recorded (Godley, Nature, 1957) that natural populations of *Cyathodes juniperina* (*C. acerosa*) in the South Island, consisted of female, fruiting plants, and non-fruiting plants in which the flowers were hermaphrodite in structure. Collections of young plants of this shrub were therefore made, and these have now begun to flower. The appropriate controlled crosses will be carried out.

CYTOLOGY

1. Chromosome Atlas (Dr J. B. Hair and Mr E. J. Beuzenberg)

Some 150 chromosome numbers have been added to the Atlas during the past three years. Genera nearing completion are *Hebe, Hydrocotyle, Schizeilema, Cotula, Poa* and *Festuca.*

The fourth paper in the interim series of Contributions to the Atlas was published in September 1960; the fifth in March 1963; and the sixth contribution is completed.

2. Podocarpaceae (Dr J. B. Hair)

Karyotype analysis in this complex family has important implications for systematics and therefore for problems of distribution.

The cytological data strongly suggest that *Podocarpus* and *Dacrydium* are unnatural genera. Among the changes recommended are the following:

(a) Section Dacrycarpus should be removed from *Podocarpus* and aligned with *Acmopyle* and probably with Florin's groups A and B of *Dacrydium.*

(b) *Microcachrys* is very close to the 30-chromosome *Dacrydiums* of Florin's group C.

(c) The *Dacrydium biforme-kirkii-bidwillii* group stands alone and probably warrants separate status.

The distribution data, when re-examined on the background of cytology, fall into more uniform patterns; bring to light probable centres of development and dispersal; and suggest lines of migration.

In summary, diverse lines of enquiry, including the cytological method, agree with Florin's concept of a southern group of conifers of which the podocarps remain a distinct assemblage, and, by extension, with the notion that their present northerly intrusions are a recent development.

In the terms of origin (Permian?) and restricted ability for dissemination, the podocarps are Paleoaustral (continental) elements, requiring land for dispersal (cf. C. A. Fleming). Their ancient affinities, which were latitudinal, and their present distribution, which is discontinuous, call for much greater proximity in the past between the southern extremities of South America, New Zealand, Australia and South Africa, and Antarctica, and historically, India should be added to this complex (cf. Florin). Despite difficulties in timing, the hypothesis of continental drift seems the most feasible explanation of disjunct distribution in the podocarps.

These findings were presented and discussed by invitation in the section Antarctic Relationships of a Triple Symposium on the Biogeography of the Pacific Basin, at the Tenth Pacific Science Congress, Honolulu, August-September, 1961, and submitted for publication as at February, 1962, under the title "Cyto-geographical Relationships of the Southern Podocarps". Financial assistance from the Royal Society

of New Zealand and from the State of Hawaii is gratefully acknowledged.

3. *Ranunculus* (Dr J. B. Hair in collaboration with Dr F. J. F. Fisher)

With the exception of *R. nivicola* (a probable amphidiploid with 2n = 96), all the alpine species so far studied are hexaploid (2n = 48). Information for *R. grahamii* is still required. Analysis of the individual karyotypes is proceeding, but is a complex process at the hexaploid level and will not be completed for some time.

An ancillary task now in progress is a cytotaxonomic analysis of the subantarctic *Ranunculi* gathered by Dr Fisher from successive expeditions to the Campbell and Auckland Islands.

4. *Nertera* (Dr J. B. Hair in collaboration with Miss R. Mason)

A survey begun in 1960 has now been completed, the 60 accessions studied ranging from North Auckland to Stewart Island and the Auckland Islands. All species except *N. setulosa* (n = 20) have 22 pairs of chromosomes. On the basis of cytology and supporting facts from floral characteristics, and field evidence, *N. setulosa* should be placed in a separate genus.

5. *Poa* (Dr J. B. Hair)

The majority of New Zealand species are tetraploid (2n = 28). A notable exception is *P. litorosa* which is 38-ploid (2n probably 266), with the highest chromosome number so far reported among monocotyledons (Hair and Beuzenberg, 1961). The plants scored, although cultivated from the time of their collection at the Auckland Islands in 1954, have not yet produced sufficient flowering material for an analysis of the breeding system.

Recent gatherings from the Campbell and Auckland Islands and from the Snares are in cultivation and their analysis complete the survey of the genus begun in 1954.

6. *Cotula* (Dr J. B. Hair in consultation with Dr E. Edgar)

Of the 24 species recognised in New Zealand, 22 belong to subgen. LEPTINELLA, one to subgen. COTULA, and one to subgen. STRONGYLOSPERMA. The present study, which was begun in 1962, indicates that each subgenus has its own basic number and polyploid series, as follows:

LEPTINELLA, x = 13 (e.g., *C. haastii,* 2n = 52 = 4x; and higher polyploids, 8x 16x, etc.). Distributed mainly in New Zealand, but also in Australia and Tasmania, and Fuegia.

COTULA, x = 5 (*C. coronopifolia,* 2n = 20 = 4x). Distributed mainly in South Africa, but extends also to Australasia and South America.

STRONGYLOSPERMA, x = 18? (or 9?) (*C. australis,* 2n = 36). Centred in Australia and Tasmania, and probably extends to South Africa.

D.S.I.R. photo by A. P. Underhill.

3. The Cytology Laboratory. (Mr E. J. Beuzenberg and Dr J. B. Hair).

D.S.I.R. photo by C. J. Miles.

4. Native Grasses as Horticultural Subjects: the Botany Division exhibit at the 1963 Summer Exhibition, Canterbury Horticultural Society.

A preliminary analysis of the karytoypes suggests two alternative possibilities for further investigation. These are:

(a) STRONGYLOSPERMA arose as an amphidiploid between COTULA and LEPTINELLA; $x = 5 + 13 = 18$; *or*

(b) LEPTINELLA is an amphidiploid between COTULA and STRONGYLOSPERMA ($x = 9$); $x = 5 + 9 = 14$, with a subsequent reduction $x = 13$.

On either hypothesis, the favoured centre of origin of the amphidiploid would be Australasia, although Antarctica cannot be excluded.

7. *Hebe* (Dr J. B. Hair and Mr E. J. Beuzenberg in consultation with Dr L. B. Moore)

The cytology of *Hebe* and its near relatives is substantially known from the work of Dr O. H. Frankel in the 1930's. The present investigation, begun in 1961, is designed to bring Frankel's results into line with Dr L. B. Moore's recent revision of the genus (in "Flora of New Zealand", Vol. 1, 1961) and to deal in addition with the wealth of new material brought to light in the past 30 years. To facilitate this task, clonal material from many of the original collections by Frankel and from the substantial additions made thereto by Mr W. B. Brockie at the Otari Gardens, Wellington, has been transferred to Lincoln by courtesy of Mr Brockie. Further collections organised by Dr Moore make a total of more than 200 accessions from authentic sources available for study (see Gardens Report). Two-thirds of this collection has been checked and preserved as voucher herbarium material.

PUBLICATIONS

(April, 1960—March, 1963)

Ashwin, M. B., 1961. *Euphrasia, Hebe* (Whipcord), *Parahebe, Pygmea.* In *"Flora of New Zealand"* Vol. I. Govt. Printer.

Atkinson, I. A. E., 1960. Forest Vegetation of the Inner Islands of the Hauraki Gulf. *Proc. N.Z. ecol. Soc.* No. 7: 29-33.

Atkinson, I. A. E., 1961. A Preliminary Account of the Vegetation of Motuhoropapa Island, Hauraki Gulf. *Tane* 8: 6-11.

Mason, G. W., Knowlton, D. L., and Atkinson, I. A. E., 1961. List of Vascular Plants from Motuhoropapa Island. *Tane* 8: 12-17.

Atkinson, I. A. E., 1961. Conservation of New Zealand Soils and Vegetation for Scientific and Educational Purposes. *N.Z. Sci. Rev.* 19: 65-73.

Atkinson, I. A. E., Bieleski, R. L., and Newhook, F. J., 1962. *Metrosideros parkinsonii* Buchan. on Little Barrier Island. *Trans. roy. Soc. N.Z.* Bot. 1: 279-284.

Atkinson, I. A. E., 1962. The Flora and Vegetation of Old Man Rock, Mercury Islands Group. *Trans. roy. Soc. N.Z. Bot.* 1: 285-287.

Atkinson, I. A. E., 1962. Semi-Quantitative Measurements of Canopy Composition as a Basis for Mapping Vegetation. *Proc. N.Z. ecol. Soc.* No. 9: 1-8.

Beuzenberg, E. J., 1961. Observations on Sex Differentiation and Cytotaxonomy of the New Zealand Species of the *Hymenantherinae* (Violaceae). *N.Z. J. Sci.* 4: 337-349.

Beuzenberg, E. J. and Hair, J. B., 1963. Contributions to a Chromosome Atlas of the New Zealand Flora—5, Miscellaneous Families. *N.Z. J. Bot.* 1: 53-67.

Connor, H. E. and Penny, E. D., 1960. Note on Proliferation in *Rubus parvus* Buchanan. *N.Z. J. Sci.* 3: 396-8.

Connor, H. E., 1960. Variation in Leaf Anatomy in *Festuca novae-zelandiae* (Hack.) Cockayne, and *F. matthewsii* (Hack.) Cheeseman. *N.Z. J. Sci.* 3: 468-509.

Connor, H. E., and Penny, E. D., 1960. Breeding Systems in New Zealand Grasses—2, Gynodioecy in *Arundo richardii* Endl. *N.Z. J. Agric. Res.* 3: 725-7.

Connor, H. E., 1960. Breeding Systems in New Zealand Grasses—3, *Festuceae, Aveneae* and *Agrostideae. N.Z. J. Sci.* 3: 728-33.

Connor, H. E., 1960. Some Aspects of the Botany of Tussock Grasslands. *Proc. 10th Lincoln College Fmrs. Conf.*: 78-81.

Connor, H. E., 1961. A Tall-Tussock Grassland Community in New Zealand. *N.Z. J. Sci.* 4: 825-35.

Connor, H. E., 1962. Studies in New Zealand *Agropyron*. Part 3. Intraspecific hybrids in *A. scabrum* (R.Br.) Beauv. *N.Z. J. Sci.* 5: 99-115.

Connor, H. E., 1962. Studies in New Zealand *Agropyron*. Part 4. Interspecific hybrids in *A. scabrum* (R.Br.) Beauv. x *A. kirkii* Zotov. *N.Z. J. Sci.* 5: 116-9.

Connor, H. E., 1963. Growth of Flowering Stems in Five New Zealand Tussock Grasses. *N.Z. J. Bot.* 1: 149-165.

Druce, A. P., 1961. Note on *Celmisia coriacea* and *Poa caespitosa* in the North Island. *Tane,* 8: 109-10.

Druce, A. P., 1961. Rediscovery of the sedge *Gahnia robusta. Wellington Bot. Soc. Bull.* No. 32: 12-14.

Druce, A. P., 1961. Orchids of the Wellington District. Notes and Additions (2). *Wellington Bot. Soc. Bull.* No. 32: 14-15.

Druce, A. P., 1962. Kind, Composition, and Status of Indigenous Vegetation. In "Soil Survey Method". *N.Z. Soil Bur. Bull.* No. 25: 193-5.

Edgar, E., 1961. Fluctuations in Mitotic Index in the Shoot Apex of *Lonicera nitida. University of Canterbury Publications*: No. 1.

Fisher, F. J. F., 1960. Comparative Physiology of Ecological Races in *Mimulus. Proc. N.Z. ecol. Soc.* No. 7: 17-19.

Fisher, F. J. F., 1960. Leaf Shape in *Ranunculus insignis. N.Z. J. Sci.* 3: 676-84.

Fisher, F. J. F., 1960. A Discussion of Leaf Morphogenesis in *Ranunculus hirtus*. *N.Z. J. Sci.* 3: 685-93.

Godley, E. J., 1960. A Note on Archibald Menzies. *Proc. roy. Soc. N.Z.* 88: 63-4.

Godley, E. J., 1960. The Botany of Southern Chile in Relation to New Zealand and the Subantarctic. *Proc. roy. Soc.* B 152: 457-75.

Godley, E. J., 1963. Breeding Systems in New Zealand Plants. 2. Genetics of the Sex Forms in *Fuchsia procumbens*. *N.Z. J. Bot.* 1: 48-52.

Hair, J. B., 1962. Basic Chromosome Numbers in *Cotula*. *Chromosome Information Service* 3: 41-42.

Hair, J. B. and Beuzenberg, E. J., 1960. Contributions to a Chromosome Atlas of the New Zealand Flora—4, Miscellaneous Families. *N.Z. J. Sci.* 3: 432-40.

Hair, J. B. and Beuzenberg, E. J., 1961. High Polyploidy in a New Zealand *Poa*. *Nature* 189: 160.

Healy, A. J., 1960. Identification of Thistles and Thistle-like Weeds. Proc. 13th N.Z. Weed Control Conf. 16-22.

Healy, A. J., 1961. The Interaction of Native and Adventive Plant Species in New Zealand. *Proc. N.Z. ecol. Soc.* No. 8: 39-43.

Healy, A. J., 1961. The Identification of Clovers in New Zealand. *Proc. 14th N.Z. Weed Control Conf.*: 22-38.

Healy, A. J., 1962. Dandelions and related Rosette Weeds in New Zealand. *Proc. 15th N.Z. Weed Control Conf.*: 53-85.

Mason, R., 1960. Three Waterweeds of the Family Hydrocharitaceae in New Zealand. *N.Z. J. Sci.* 3: 382-95.

Mason, R., 1961. Dispersal of Tropical Seed by Ocean Currents. *Nature* 191: 408-9.

Moar, N. T., 1960. Studies in Pollen Morphology—1, The New Zealand Species of *Hydrocotyle* L. *N.Z. J. Sci.* 3: 51-60.

Moar, N. T., 1960. Studies in Pollen Morphology—2, The Pollen of the New Zealand and of two Australian Species of *Callitriche* L. *N.Z. J. Sci.* 3: 415-21.

Moar, N. T., 1961. Contributions to the Quaternary History of the New Zealand Flora. 4. Pollen Diagrams from the Western Ruahine Ranges. *N.Z. J. Sci.* 4: 350-9.

Moore, L. B. and Simpson, M. J. A., 1961. Row Trials of Grasses at Molesworth Station. *N.Z. J. agric. Res.* 4: 83-98.

Moore, L. B., 1961. Roadside Scrub near Cape Runaway. *Wellington bot. Soc. Bull.* No. 32: 5-7.

Moore, L. B., 1961. Distribution Patterns in New Zealand Seaweeds. *Tuatara,* 9: 18-23.

Moore, L. B., 1961. *Boraginaceae, Caryophyllaceae, Plantaginaceae, Hebe, Ourisia, Pomaderris,* etc., as set out in Preface in *"Flora of New Zealand"*, Vol. 1. Govt. Printer.

Sykes, W., 1961. Observations on Plants at Tresco. I. *Gdnr's Chron.* 150: 274-5. II. *Ibid,* 150: 299.

Wardle, P., 1960. The Subalpine Scrub of the Hokitika Catchment Westland. *Trans. roy. Soc. N.Z.* 88: 47-61.
Wardle, P., 1961. The Effect of Deer on Subalpine Forest and Scrub. *Proc. N.Z. ecol. Soc.* No. 8: 52-4.
Wardle, P., 1961. The Forest of Aniseed Stream near Kaikoura. *N.Z. J. For.* 8: 477-81.
Wardle, P., 1961. Biological Flora of the British Isles. *Fraxinus excelsior* L. *J. ecol.* 49: 739-51.
Wardle, P., 1962. Subalpine Forest and Scrub in the Tararua Range. *Trans. roy. Soc. N.Z. Bot.* 1: 77-89.
Wardle, P., 1962. Soils and Vegetation of Secretary Island. *Proc. N.Z. ecol. Soc. No.* 9. 27-30.
Wardle, P., 1963. Evolution and Distribution of the New Zealand Flora as Affected by Quaternary Climates. *N.Z. J. Bot.* 1: 3-17.
Wardle, P., 1963. Growth Habits of New Zealand Subalpine Shrubs and Trees. *N.Z. J. Bot.* 1: 18-47.
Molloy, B. P. J., Burrows, C. J., Cox, C. J., Johnston, J. A., and Wardle, P., 1963. Distribution of Subfossil Forest Remains, Eastern South Island, New Zealand. *N.Z. J. Bot.* 1: 68-77.
Zotov, V. D., 1963. Synopsis of the Grass Subfamily *Arundinoideae* in New Zealand. *N.Z. J. Bot.* 1: 77-136.

GENERAL ARTICLES

Connor, H. E. and West, K. R., 1961. "Kea Point Nature Walk", 2nd rev. ed. Mount Cook National Park Board.
Connor, H. E., 1962. Something About the Plants (with additions and nomenclatural revisions). In "Mount Cook National Park", 3rd ed., edited by H. E. Connor. Mount Cook National Board.
Connor, H. E., 1960. Poisonous Plants in New Zealand. *N.Z. Dept. Agric. Bull.* 356. 2nd and rev. ed.
Druce, A. P., 1961. Abandoned—Through want of Space? *Wellington bot. Soc. Bull.* No. 32: 16-17.
Godley, E. J., 1961. Fauna and Flora. In "Distance Looks Our Way". Paul's Book Arcade for the University of Auckland.
Godley, E. J., 1962. Notes on Mendel's Experiments in Heredity in "Biology for Sixth Forms", by R. M. Miller *et al.* Otahuhu. Teach and Test Publications (Modified from N.Z. School Sci. 1957).
Moore, L. B., 1960. Some Botanical Features of Wellington. In "Science in Wellington". Roy. soc. N.Z. 14-16.

REVIEWS

Connor, H. E., 1961. "Flora of New Zealand" Vol 1. *The Press* 100 (29560): 3. 8 July.
Godley, E. J., 1961. "Flora of New Zealand", Vol. 1. *N.Z. Listener,* 20 Oct.
Godley, E. J., 1962. "The Story of Pollination". *N.Z. Sci. Rev.* 20: 57.
Godley, E. J., 1962. "Rock Garden Plants of the Southern Alps". *N.Z. Listener,* 2 Nov.

HONOURS AND AWARDS

Miss L. B. Moore. Doctor of Science, University of Canterbury, 1962.

OVERSEAS VISITS

Dr J. B. Hair was invited to attend the Tenth Pacific Science Congress at Honolulu in August–September, 1961 and took part in the Antarctic Relationships Section of a Triple Symposium on the Biogeography of the Pacific Basin.

Mr N. T. Moar began research at the Botany School, Cambridge University, in June 1961 on Late-glacial vegetation changes in Scotland.

Dr P. Wardle is spending a year from September 1962 at the Institute of Arctic and Alpine Research, University of Colorado studying the physiology and ecology of woody plants at timberline.

OVERSEAS VISITORS

Dr Pierre Dansereau, Assistant Director (Botany) and Senior Curator of the New York Botanical Garden, visited the west coast, South Island, on 25-28 May, 1961, with a party including E. J. Godley, P. Wardle and I. A. E. Atkinson. Dr Dansereau spent a day at Botany Division on 1 June.

Dr Ronald Melville, Royal Botanic Gardens Kew, spent from October 1961 to May 1962 at the Division as a D.S.I.R. Senior Research Fellow. He collected widely in New Zealand from North Auckland to Stewart Island.

Dr Jane Taylor of The Queen's University, Belfast, spent from May 1961 to March 1963 at Botany Division, as D.S.I.R. National Research Fellow. A summary of her work is included in this report.

Other visitors included: Dr and Mrs Mason, University of California, Berkeley; Dr and Mrs N. T. Penfound, University of Oklahoma; Dr H. B. S. Womersley, University of Adelaide; Dr Sherwin Carlquist, Rancho Santa Ana Botanic Gardens, California; Miss Helen Dorrien-Smith, Tresco Abbey, Isles of Scilly; Dr J. Cooper, Aberystwyth; Dr and Mrs E. Rudolph, Ohio State University; Dr R. E. Norris, University of Minnesota and Professor R. D. Wood, Rhode Island University.

COMMITTEES AND APPOINTMENTS

Mr I. A. E. Atkinson. Botanical Committee, Tongariro National Park Board.

Mr H. E. Connor. North Canterbury Nassella Tussock Board; North Canterbury Catchment Board; Mount Cook National Park Board.

Dr E. J. Godley. Hon. Lecturer, University of Canterbury; Hon. Lecturer, Lincoln College, University of Canterbury; Marlborough Nassella Tussock Board; Committee of Management, Tussock Grasslands and Mountain Lands Institute (1962-63); Botanical Committee, Tongariro National Park Board; Board of Governors, The Miss E. L. Hellaby Indigenous Grasslands Research Trust; Biology Committee, Royal Society of New Zealand.

Dr J. B. Hair. Hon. Lecturer, Lincoln College, University of Canterbury.

Mr A. J. Healy, Interdepartmental Committee on Nassella Tussock.

Dr L. B. Moore. Systematic Botany Committee, Section M, of A.N.Z.A.A.S.

Mr W. R. Sykes. Nomenclature Committee, Royal New Zealand Institute of Horticulture.

RESIGNATIONS

Mr B. L. Nichols, Officer in Charge of Gardens from April, 1956 transferred to Lands and Survey Department, Taupo on 1.10.60.

Mr H. Herkert, Technician from 2.2.59, resigned on 13.9.61.

Miss J. D. Harrison, Technician from 27.2.56, resigned on 11.3.62.

Miss M. R. Jackman, Typist from 23.11.59, transferred to Entomology Division, Nelson, on 3.4.62.

Mr G. C. Jackson, Technician (Taita) from 7.2.62, resigned on 31.8.62.

OBITUARIES

Mr C. M. Smith, Third Director of Botany Division who retired on 31.12.57 died in Wellington on 24th May, 1961. An appreciation of Mr Smith's work was given in the last Triennial Report.

Mr R. J. L. Sheehy, Senior Clerk at Botany Division died, after a short illness, on 27 July, 1961. Mr Sheehy came to Botany Division on 31.3.54, from the Department of Internal Affairs at Queenstown, soon after the Division transferred to Christchurch. He was thus intimately associated with a very active period in the development of the Division's work and facilities, both in Christchurch and during our shift to Lincoln and establishment in a new home. We are all indebted to him for his devotion to the work of the Division and for the help which he gave in so many directions. And we extend our deep sympathy to his widow and children.

STAFF REPLACEMENTS

Mr G. C. Jackson	7.2.62	Technician, Taita. (vice H. Herkert).
Mr V. F. Pennington	12.2.62	Senior Clerk, transferred from Ministry of Works (vice R. J. Sheehy).
Mrs H. J. Birch		Typist, transferred from Air Department (vice M. R. Jackman).
Mr I. R. Fryer	3.1.63	Technician, adventive plants, transferred from Department of Lands and Survey (vice G. C. Jackson).
Miss K. C. Jansen	21.1.63	Technical trainee, herbarium (vice J. D. Harrison).

NEW POSITIONS

Mr W. R. Sykes	7.7.61	Taxonomy of horticultural plants.
Mr A. H. MacRae	13.7.61	Technician, ecology.
Miss A. Latter	4.2.63	Technical trainee, flora revision.

STAFF LIST

(1.4.63)

DIRECTOR: Dr E. J. Godley

ASSISTANT DIRECTOR: Mr A. J. Healy

RESEARCH STAFF

	Professional Division	*General Division*
Flora Revision		
Monocotyledones	Dr Lucy B. Moore Dr Elizabeth Edgar	Miss A. Latter
Grasses	Mr V. D. Zotov	Mr B. M. Gilpin
Adventive Plants	Mr A. J. Healy	Mr I. R. Fryer
Horticultural Plants	Mr W. R. Sykes	
Herbarium	Mr T. W. Rawson	Mr A. A. Sutherland Miss B. H. Macmillan Miss K. C. Jansen
Genetics	Dr E. J. Godley	
Cytology	Dr J. B. Hair	Mr E. J. Beuzenberg
Experimental Taxonomy, Ecology and Vegetation Surveys	Mr H. E. Connor Dr P. Wardle Miss R. Mason	Mr A. H. MacRae Mrs M. J. A. Bulfin
Morphogenesis	Dr F. J. F. Fisher	
Quaternary History	Mr N. T. Moar	
Botanical Artist		Mr K. R. West
Librarian		Miss B. E. Harris
Asst. Librarian		Mrs M. E. Blackmore

NORTH ISLAND SUB-STATION (TAITA)

Ecology and Vegetation Surveys	Mr A. P. Druce Mr I. A. E. Atkinson

EXPERIMENTAL GARDENS

Officer in Charge: Mr I. C. Brown

Staff: Mr W. Broomhall, Miss J. Clarke, Mr C. H. Fletcher, Mr G. F. Heasley, Mr C. R. Hogan, Mr R. A. J. Marcon, Mr R. W. Smith.

ADMINISTRATION

Senior Clerk:	Mr V. F. Pennington
Typist:	Mrs H. J. Birch